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North American Pyraustinae: Notes and Descriptions (Lepidoptera: Pyralidae)[1]

By Eugene G. Munroe[2]
Systematic Entomology, Division of Entomology
Ottawa, Canada

Framinghamia Strand

Framinghamia Strand, 1920: 160. Monotype: [*Pionea helvalis* Walker=] *Framinghamia botys* Strand.

The common species *helvalis* Walker has ordinarily been placed in *Phlyctaenia* Hübner; this arrangement is unnatural even on the old definition of the genus. The third joint of the labial palpus is exposed and the species runs to *Archernis* in Hampson's (1898) key. The species of that genus, however, are of much stouter build and have radically different genitalia; there is accordingly, I think, no direct relationship. *Framinghamia helvalis* (Walker), new combination, like the species of *Archernis*, belongs to the group of Pyraustinae that has lost the frenulum hook. *Framinghamia* may be differentiated from *Udea* by the different configuration of the palpi (Fig. 12), as well as by genitalic characters (Fig. 8). Among the more striking features of the male genitalia are the absence of the uncus, the conspicuous fringe of long, heavily pigmented scales along the costa of the valve, the broad transtilla, the minute, furcate juxta, and the twisted, ribbon-like coremata, with simple scent tufts.

Trischistognatha Warren

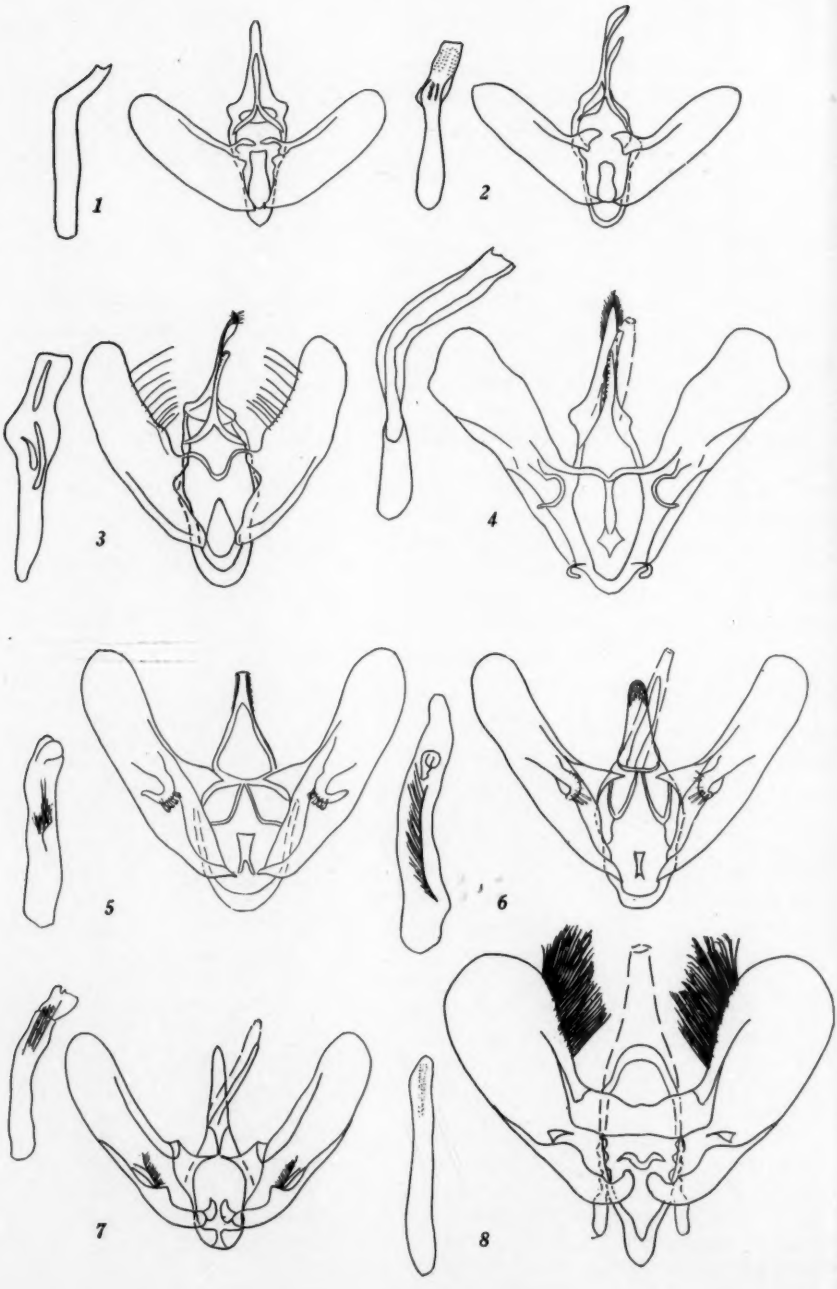
Trischistognatha Warren, 1892: 429. Monotype: *Spilodes palindialis* Guenée.

This generic name was sunk by Hampson (1898) as a synonym of *Crocidolomia* Zeller. By an oversight, McDunnough (1939) listed its type species in the very distinct genus *Crocidophora* Lederer. Schaus (1940) gave *Trischistognatha* as a section of *Crocidolomia*. *Trischistognatha* should stand as a genus separate from *Crocidolomia*, although the two are certainly closely related. The general facies of *Trischistognatha* is very different from that of *Crocidolomia*, the male genitalia show considerable differences (greater than those which separate *Crocidolomia* from several related genera), and there are also clear-cut external differences. The distinguishing features of *Trischistognatha* are summarized in the following brief description.

Labial palpus shorter than in *Crocidolomia* (Figs. 9, 10), second joint no longer than deep, third joint short and obtusely pointed. Antenna annulated with scales at ends of joints and subserrate below, not smooth as in *Crocidolomia*. Wing venation similar to that of *Crocidolomia*; 3A of fore wing not forming a loop, but proceeding directly to the inner margin at one-third of its length from the base.

The male genitalia of *Crocidolomia* (Fig. 3) are closely similar to those of *Evergestis*. Those of *Trischistognatha* (Fig. 4) differ from those of *Crocidolomia* in having the uncus weakly sclerotized; in having a distinct subscaphium attached to the anal tube, in addition to the free and dorsally denticulate gnathos; in having the valve truncate at the apex and provided internally with a strongly sclerotized, sickle-shaped, spine-like process; and in the form of the juxta, which

[1]Contribution No. 2800, Division of Entomology, Science Service, Department of Agriculture, Ottawa, Canada.
[2]Agricultural Research Officer.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consists of a ventral rhomboidal plate fused with a dorsal, denticulate tube. The aedoeagus resembles that of *Evergestis*, being sharply angulate near the middle.

The structure of the male genitalia shows that these two genera are closely related to *Evergestis*. They are not directly related either to *Ommatospila* or to *Hellula*, near which they were placed by Hampson.

T. palindialis (Guenée) has been recorded from Florida by Dyar. I have a specimen from Florida City, Fla., collected on May 27, 1940, by Mrs. L. E. Forsyth.

***Evergestis unimacula* (Grote and Robinson), new combination**

Asopia unimacula Grote and Robinson, 1867: 14; pl. 2, fig. 8.
Pyrausta unimacula Hampson, 1899: 270.

This species is badly misplaced in *Pyrausta*, as it has the third joint of the labial palpus exposed and male genitalia of the *Evergestis* type (Fig. 2). I can find no character to separate *unimacula* from the other species of *Evergestis*, and accordingly I refer it to that genus, although the maculation of the wings is somewhat atypical.

***Cylindrifrons*, new genus**

Type: *Botis succandidalis* Hulst.

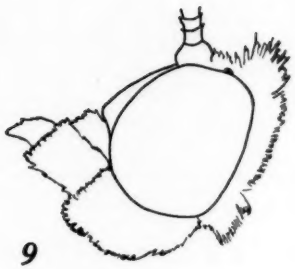
Frons provided with a stout, subcylindrical tubercle (Fig. 11), weakly convex at the end; labial palpus obliquely porrect, third joint exposed, short and blunt; compound eye of moderate size; ocellus close to base of antenna; antenna with base large, shaft filiform, scaled above, very sparsely ciliated. Body moderately robust; legs rather short and stout; fore femur thickened in both sexes; fore tibial epiphysis large, main part scaled, tip naked, acute, and deflected outward. Fore wing with outer margin oblique, somewhat convex; SC ending at about two-thirds of the length of costa from base; radius rather far removed from costal margin; R_1 arising at about three-fifths of the length of cell from base; R_2 arising from near end of cell; R_3 and R_4 long-stalked; R_5 weakly curved, not approximated to R_{3+4}; M_1 from distinctly below end of cell; discocellular concave outward; M_2, M_3, and Cu_1 well separated at their bases and thence evenly divergent; Cu_2 arising about three-fourths of the length of the cell from the base; 3A free, not forming a loop with 1A; frenulum hook present in male. Hind wings with SC and R anastomosing for a short distance beyond the cell; M_1 stalked for a very short distance with R; discocellular concave, outward, the lower portion very strongly oblique; M_2, M_3, and Cu_1 well separated at base. Male genitalia (Fig. 1) without conspicuous differences from those of *Evergestis*.

The type species has usually been placed in *Loxostege* but is not closely related to that genus. The affinities of *Cylindrifrons* are with *Evergestis* and *Cornifrons*, but *Cylindrifrons* may be distinguished by the shape of the frontal process and by the fact that M_2 and M_3 are well separated in the hind wing, instead of being somewhat approximated as in the other two genera.

***Loxostege ephippialis* (Zetterstedt), new combination**

Botys ephippialis Zetterstedt, 1840: 972.
Titanio ephippialis, Hampson, 1899: 235.

Fig. 1. *Cylindrifrons succandidalis*, ♂ genitalia.
Fig. 2. *Evergestis unimacula*, ♂ genitalia.
Fig. 3. *Crocidolomia binotalis*, ♂ genitalia.
Fig. 4. *Trischistognatha palindialis*, ♂ genitalia.
Fig. 5. *Pyrausta socialis*, ♂ genitalia.
Fig. 6. *Pyrausta fodinalis*, ♂ genitalia.
Fig. 7. *Pyrausta dapalis*, ♂ genitalia.
Fig. 8. *Framinghamia helvalis*, ♂ genitalia.



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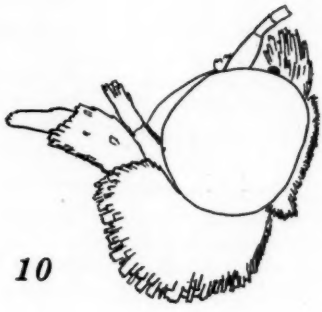

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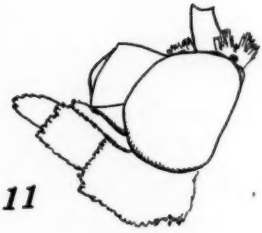

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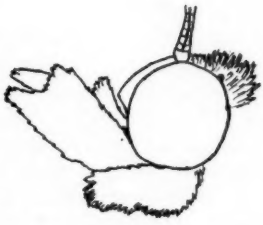

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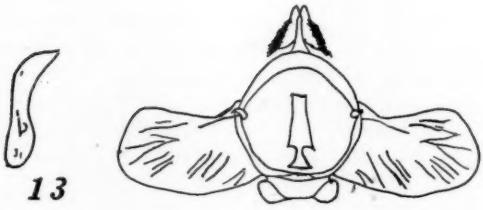

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Sylvén (1947) has shown that the genitalia of this species closely resemble those of the species of *Loxostege*, which he includes in his very broad concept of *Pyrausta*. As a result of Sylvén's investigations it appears that the conical frontal prominence that is ordinarily used as a distinguishing character for *Loxostege* may be absent in some species that are in other respects typical members of the genus. None the less, the group appears to be homogeneous and easily defined on genitalic characters, and I think that it will eventually stand as clearly distinct from *Pyrausta*. Sylvén's views were conditioned by the very small number of species with which he worked and, although the assemblage of species that he includes in *Pyrausta* may be convenient from the standpoint of the Swedish fauna, it is a vast and heterogeneous group of totally unmanageable size when considered on a global basis.

Loxostege ephippialis has the conical frons that is typically found in the species of this genus, and has been referred to *Titanio* chiefly on the basis of the hairy palpi. This modification is, however, found in arctic species of a number of widely different groups, and does not necessarily have any fundamental significance. The close similarity of the genitalia of *L. ephippialis* to those of the *commixtalis* group makes the new generic reference seem entirely proper. The clear delimitation of the genus will have to await the study of a longer series of forms.

Pyrausta dapalis (Grote), new combination

Botis dapalis Grote, 1881: 17.
Titanio daphalis [sic], Hampson, 1899: 236.

This species is closely similar in both external structure and male genitalia (Fig. 1) to *Pyrausta nigrata*, the type of the genus; the aedoeagus, however, has what appear to be deciduous cornuti, and consequently the species will probably not fall into the greatly restricted genus *Pyrausta* as defined by Pierce and Metcalfe (1938). It is too soon as yet to separate the North American species into generic units as small and minutely characterized as those established by Pierce and Metcalfe for the British fauna. The present species will fit very well into the rather inclusive concept of *Pyrausta* that is now current in American lists. It has no close relationship to *Titanio*, whose species, some of which have been figured by Sylvén, have genitalia of an entirely different type. *T. proximalis* Fernald, which resembles *dapalis* in superficial appearance and which stands next to that species in McDunnough's list, is not related, but has genitalia of the *Titanio* type.

The removal of *ephippialis* and *dapalis* by no means clears the genus *Titanio* of extraneous elements. A full revision of this section of the sub-family will, however, require an examination of the type species, many of which are at present unavailable to me, of a considerable number of nominal genera.

Pyrausta socialis (Grote)

Botis socialis Grote, 1877: 107.
Pyrausta fodinalis Hampson, 1899: 262 (in part).

Examination of the series placed in the Canadian National Collection as *Pyrausta fodinalis* showed that two species were being confused under this name. One of these species agrees moderately well with Lederer's (1863, Pl. 8,

Fig. 9. *Trischistognatha palindialis*, head, lateral aspect.
Fig. 10. *Crocidolomia binotalis*, head, lateral aspect.
Fig. 11. *Cylindrifrons succandidalis*, head, lateral aspect.
Fig. 12. *Framinghamia helvalis*, head, lateral aspect.
Fig. 13. *Titanio criddlealis*, ♂ genitalia.
Fig. 14. *Noctuelia atascaderalis*, ♂ genitalia.

Fig. 3) figure of *Botys fodinalis*, the other is in excellent agreement with Grote's description of *Botis socialis*. The name *socialis* must accordingly be resurrected from synonymy; *Pyrausta socialis* is closely related to *fodinalis*, and can stand next to it in the list.

P. socialis (Pl. 1, Fig. 2) differs from *P. fodinalis* (Pl. 1, Fig. 1) in the following respects. In general appearance more brightly and more evenly coloured; fore wings rather evenly pinkish brown, not pale, dull brown as in *fodinalis*; subterminal shade of fore wing strongly and evenly developed in *socialis*, weak or obsolescent or fading out posteriorly in *fodinalis*; fringe of fore wing contrastingly pale or dull in *socialis*, concolorous in *fodinalis*; hind wing pale yellowish brown in *socialis*, brownish white in *fodinalis*, rarely with a yellowish tint; postmedial line of hind wing usually absent in *socialis*, usually at least faintly indicated in *fodinalis*.

The male genitalia of *socialis* (Fig. 5) differ from those of *fodinalis* (Fig. 6) in having the uncus more slender and provided with a lateral point on either side at the tip, in having the valve broader, with a much larger hooked spine on the inner surface, and in having larger and stronger cornuti. The two species belong to *Pyrausta* only in the broad sense.

Both species are transcontinental in range. I have seen *P. fodinalis* from Quebec, Ontario, Manitoba, Saskatchewan, Alberta, British Columbia, and Utah, and *P. socialis* from Quebec, New York, Ontario, Manitoba, Alberta, British Columbia and Colorado. *P. fodinalis* was described from California and *P. socialis* from New York and "Canada" (evidently Ontario).

Pyrausta perrubralis Packard

Botys perrubralis Packard, 1873: 264.

This species was described from California, presumably from the San Francisco region. I have seen six approximately topotypical specimens (from Marin, Alameda, and Sta. Clara counties) (Pl. 1, Fig. 3). These agree with one another and with the original description in the small size, the ochreous yellow ground colour of the fore wing, the well marked red antemedial and medial lines and the fuscous postmedial scaling of the same wing, and in the strong postmedial shade and pink fringe of the hind wing.

Botys scurralis Hulst, 1886: 155, was listed by McDunnough (1939) as a subspecies of *P. perrubralis*, with *Pyrausta postrubralis* Hampson, 1899: 262 as a synonym. I believe that this arrangement is correct, and I refer a series in the Canadian National Collection from Aweme, Man., to this subspecies (Pl. 1, Fig. 4). These agree with Hulst's description in having the ground colour of the fore wing clear yellow, in lacking the antemedial and medial red lines and the fuscous postmedial shade, and in having the fringes largely yellowish, without red suffusion. The postmedial band of the fore wing is unicolorous pink and is broader than in typical perrubralis, and more sharply delimited distally; on the hind wing the postmedial band is broader and fainter than in the typical subspecies. Three specimens from Manitoba and one from Arizona in the Lyman Collection, Redpath Museum, McGill University, are similar to those just described. Two specimens in the Canadian National Collection from the Huachuca Mts., Arizona, are, however, different, approaching typical *perrubralis* in some characters. These specimens may represent a distinct subspecies, but in the absence of further material it is impossible to be sure.

Pyrausta perrubralis saanichalis, new subspecies

On Vancouver Island an apparently distinct subspecies exists (Pl. 1, Fig. 5). This resembles typical *perrubralis* in several respects, but differs from it as follows.

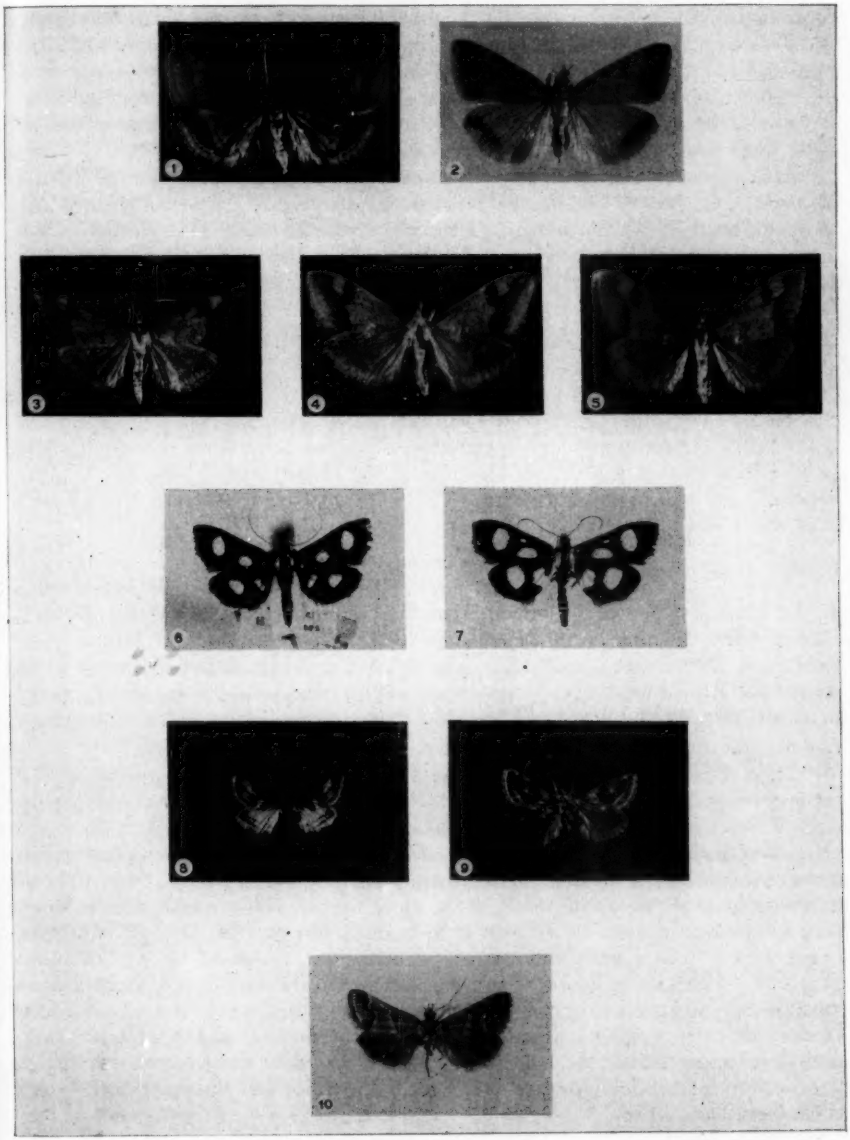

PLATE 1

Fig. 1. *Pyrausta fodinalis* ♂
Fig. 2. *Pyrausta socialis* ♀
Fig. 3. *Pyrausta perrubralis perrubralis* ♂
Fig. 4. *Pyrausta perrubralis saanichalis* ♀
Fig. 5. *Pyrausta perrubralis scurralis* ♂
Fig. 6. *Pyrausta funebris funebris* ♂
Fig. 7. *Pyrausta funebris glomeralis* ♂
Fig. 8. *Titanio criddlealis* ♂
Fig. 9. *Titanio criddlealis* ♀
Fig. 10. *Noctuelia atascaderalis* ♂

Size larger, length of fore wing averaging about 15 mm. as against 11 mm. in specimens of the typical subspecies (Packard, however, gives 0.48 to 0.54 inches as measurements of the type series); ground colour of fore wing clear yellow; dark markings less strongly contrasting, antemedial line narrow and medial line weak or obsolete, postmedial band of fore wing without fuscous scales, although with inner edge of somewhat deeper pink than the remainder; postmedial band of hind wing weak and diffuse.

Holotype, male, Duncan, B.C., July 28, 1919 (W. Downes); allotype, female, Victoria, B.C., July 4, 1915 (E. H. Blackmore); paratypes: 2 males, Victoria, B.C., Aug. 26, 1917 (E. H. Blackmore); 1 male, 1 female, Saanich District, B.C., Aug. 9 and 14, 1919 (W. Downes); 1 male, Maple Bay, Vancouver Island, B.C., July 12, 1933 (J. McDunnough); 1 female, Duncan, B.C., July 28, 1919 (W. Downes). Type No. 5935, C.N.C.

***Pyrausta funebris glomeralis* (Walker)**

Ennychia glomeralis Walker, 1859: 330.

The North American population of this species (Pl. 1, Fig. 6) differs from that found in Europe (Pl. 1, Fig. 7) in the much larger average size of the two white spots of each wing, and in the more frequent occurrence of an additional small white spot in the cell of the fore wing. The name *glomeralis* Walker, based on specimens from St. Martin's Falls, Albany River and from Nova Scotia, is available and may be used in a racial sense.

***Titanio criddlealis*, new species**

A short series of the *Titanio helianthalis* group from Aweme, Man., has stood in the Canadian National Collection under the name *Titanio belialis* (Druce). One of the specimens bears a label that reads, "*Cybalomia belialis* Druce ?—or near this. Det. Busck 19.1.1915". The species does not, however, agree at all well with Druce's original description and figure of *belialis*. It is closely related to *helianthalis* Murtfeldt and still more closely to *laetalis* Barnes and McDunnough. A description of the new species follows:—

Male (Pl. 1, Fig. 8). Fore wing with ground colour, most of the veins, and the median and submedian folds pale gray with a few fulvous scales interspersed; large diffuse basal, medial, and postmedial patches of dark gray with scattered fulvous scales; a narrow, ill defined, white postmedial line curving somewhat more strongly than the outer margin, beginning at the costa about four-fifths of its length from the base and ending at the inner margin; subterminal space fulvous, with some fuscous scales on its inner half; terminal line narrow, black, continuous; fringe broad, white, with an interrupted black line followed by a continuous gray one. Hind wing white, with a few scattered gray scales, and with diffuse subterminal and terminal gray bands; fringe white, with an interrupted gray line. Under side of fore wing uniformly fuscous, with fringe as above, of hind wing, similar to upper side. Male genitalia (Fig. 13) closely similar to those of *T. laetalis* Barnes and McDunnough, but with the gnathos and the juxta both somewhat more slender.

Female (Pl. 1, Fig. 9). Similar to male, but with the hind wing above and below uniformly fuscous, except for the fringe, which is white with a gray line. This species stands close to *T. laetalis*, but differs in the darker and more strongly contrasting maculation, the general gray colour, and the uniformly dark under side of the fore wing.

Holotype, male, allotype, female, and four male paratypes, all taken at Aweme, Man., at various times from May to August, by N. Criddle. Type No. 5936 C.N.C.

***Noctuelia atascaderalis*, new species**

Male (Pl. 1, Fig. 10). Palpus brown with scattered white scales, paler below; frons brown with a white line at each side; antenna brown, scaled with white above. Body brown, paler below; fore legs brown, mid and hind legs very pale brown. Fore wing dull fulvous brown with discal third paler; antemedial line narrow, dark, followed sharply by a pale shade, which blends into the discal ground colour; course of the line oblique, nearly straight, extending from costa at one-third to inner margin at one-fourth; orbicular absent, reniform a small, fuscous, transverse dash; postmedial line dark, margined inwardly by a pale shade, faintly incurved above the cell and more strongly incurved below it; subterminal line white, parallel to outer margin, not reaching either costa or inner margin; fringe uniformly dull orange. Hind wing uniformly fuscous, relieved only by two consecutive short pale dashes in the submedian fold; fringe pale ochreous. Fore and hind wings beneath light fuscous, with paler shades on costal margins; fringes pale brown, each with a fuscous line. Genitalia (Fig. 14) resembling those of *N. palmalis* Barnes and McDunnough, but with valve broader and more rounded and aedoeagus with a shorter and more regularly curved cornutus.

In external appearance this species closely resembles *N. puertalis* Barnes and McDunnough and *N. palmalis* Barnes and McDunnough. The wings are broader, the antemedial line is more regular and more oblique, the reniform spot is not so well developed, and the postmedial line is much less strongly sinuous and is more regular; the hind wings are darker and have a uniform ground colour.

Holotype, male, Atascadero, Calif., July 26, 1935, E. C. Johnston. Type No. 5937 C.N.C.

The female is unknown.

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Some Synonymy and New Combinations in Chalcidoidea (Hymenoptera)

By A. B. GAHAN

At the time of my retirement on December 31, 1950, a number of notes on synonymy and generic transfers had accumulated. Many of these are thought worthy of publication and this paper is made up of a number of them. Those included notes which deal with Nearctic forms will clarify the treatment of certain genera and species in the catalog of North American Hymenoptera, now in process of publication by the U.S. Department of Agriculture, the Chalcidoidea section of which catalog was assembled and edited by O. Peck of the Canadian Department of Agriculture but which is based in great part upon the classification and arrangement of the collection in the United States National Museum. The catalog will probably appear in print before this paper does. Several notes dealing with forms not known to occur in the Nearctic region, hence not appearing in the catalog, are also included.

Family EULOPHIDAE

Pleurotropis aphidiphagus (Ashm.), new combination

Entedon aphidiphagus Ashm., Trans. Amer. Ent. Soc. vol. 14, p. 201, 1887.

Asecodes quercicola Ashm., Bul. 3, Kans. St. Agr. Col., App. p. 8, 1888. New synonymy.

Pleurotropis quercicola (Ashm.) Crawford, Proc. U.S. Nat. Mus. vol. 43, p. 178, 1912.

Two specimens from Jacksonville, Florida, carrying the name label *Entedon aphidiphagus* in Ashmead's handwriting are in the U.S. National Museum. These specimens agree with the short original description and are quite certainly the types. According to Ashmead the types were reared from *Siphonophora citrifolii* Ashm. The species is a typical *Pleurotropis* and is identical with *P. quercicola* Ashm., a species that was originally reared from an "oak apple" at Manhattan, Kansas, and has since been reared from *Amphibolips inanis* O. S. galls collected at Quebec, Canada in August 1941 by J. C. Beaulne. Other specimens, without indicated host records, are in the collection from White Heath, Illinois, and Bedford, Indiana.

The record of *Siphonophora citrifolii* as host to this species is believed to be wrong since no other species of *Pleurotropis* has been found associated with aphids and it seems unlikely that the same species would attack aphids on citrus and infest cynipid galls on oak. The specific name *aphidiphagus* is quite inappropriate but unfortunately must be used.

Pleurotropis secundus Girault, new combination

Pseudacrias secundus Gir., New Javanese Hymenoptera, p. 7, 1917.

Pleurotropis anomala Gahan, Phil. Jour. Sci. 17, p. 348, 1920. New synonymy.

I can see no differences between the types of *Pseudacrias secundus* Girault, said to have been reared from a spider egg-sac in Java, and *Pleurotropis anomala* Gahan, supposed to have been reared from the buprestid *Endelus bakeri* Kerremans in Luzon, Philippine Islands. Despite the very different host records, I believe the two names represent the same species.

Pleurotropis elasmi (Ashmead), new combination

Asecodes elasmi Ashm., Proc. U.S. Nat. Mus. 28, p. 138, 1904.

This species is a *Pleurotropis*. In Ferriere's key to South Asiatic species of that genus it runs to couplet 4 but differs from both *detrimentosus* Gahan and *parvulus* Ferriere, placed under that couplet, by having the frons and vertex strongly punctate instead of perfectly smooth.

***Tetrastichus tineivorus* Ferriere**

Tetrastichus sp. Geigy & Zinckernagel, Mitt. Schw. Ent. Ges., vol. 18, p. 225, 1941.
Tetrastichus tineivorus Ferr., Mitt. Schw. Ent. Ges., vol. 18, p. 376, fig. 1, 1941.
Tetrastichus carpatus Burks, Proc. U.S. Nat. Mus., vol. 93, p. 566, 1943. New synonymy.

Paratypes of *Tetrastichus carpatus* Burks were sent to Dr. Ch. Ferriere of the Museum of Natural History, Geneva, Switzerland for comparison with the type of *T. tineivorus* Ferriere. Dr. Ferriere was unable to find any differences between them but in exchange he sent to the U.S. National Museum paratypes of *T. tineivorus* for confirmation of his conclusion. These paratypes have been compared with the type of *T. carpatus* by both Dr. B. D. Burks and me with the result that we are of the same opinion as Ferriere, viz. that *carpatus* is a synonym.

***Tetrastichus minutus* (Howard)**

In Bulletin 37 of the United States Division of Entomology, 1902, p. 86-87, and again in Proceedings of the Entomological Society of Washington, vol. V, 1903, p. 138, Dr. C. L. Marlatt recorded the rearing of *Syntomosphyrum esurus* Riley from pupae of the coccinellid, *Chilocorus similis* Rossi. A large series of specimens in the National Collection which undoubtedly represent the material upon which this record was based has recently been examined and found to be not *Syntomosphyrum esurus* but *Tetrastichus minutus* (Howard).

Family ENCYRTIDAE

***Dinocarsiella alpina* (Girault), new combination**

Anagyrus alpinus Gir., Descriptiones Stellarum Novarum, p. 5, 1917.
Dinocarsiella zebrata Mercet, Fauna Iberica Himenopteros Fam. Encirtidos, p. 145, 1921. New synonymy.

Girault described this species from one female, reared from *Dactylopius glaciale* (Newst.) at Mouraine Courmaguer, Switzerland, (altitude 4,000 feet) by Robert Newstead in October, 1899. The type which is in the U.S. National Museum agrees with the description and figure of *Dinocarsiella zebrata* Mercet and I feel quite sure the two species are identical.

***Apterencyrtus* Ashmead**

Apterencyrtus Ashm., Can. Ent. 37, p. 5, 1905.
Chiloneurinus Mercet, Fauna Iberica Himenopteros Fam. Encirtidos, p. 646, 1921. New synonymy.

The genotypes of *Aperencyrtus* Ashm. and *Chiloneurinus* Mercet are identical in my opinion. (See discussion of species below). *Aperencyrtus* is the older name and must be used for the genus despite the fact that it is an obvious misnomer since the genotype species is fully winged.

***Apterencyrtus microphagus* (Mayr), new combination**

Cheiloneurus microphagus Mayr, Verh. Zool. bot. Ges. Wien, 25, p. 745, 1875.
Apterencyrtus pulchricornis Ashm., Can. Ent., 37, p. 5, 1905. New synonymy.
Chiloneurinus microphagus (Mayr) Mercet, Fauna Iberica, Himenopteros Fam. Encirtidos, p. 647, 1921.
Cheiloneurinus microphagus (Mayr) Gahan, Proc. U.S. Nat. Mus. 65, Art. 4, p. 1, 1924.

Apterencyrtus pulchricornis Ashm. (genotype of *Apterencyrtus*) was described from one female specimen taken at Manila, P.I. This type is not truly apterous, in my opinion, but is a specimen the wings of which have been broken off. Jagged stumps of wings are plainly present. In its remaining characters this specimen is precisely like *Cheiloneurus microphagus* Mayr (genotype of *Chiloneurinus* Mercet) and I believe it to be that well known species.

Family EUPELMIDAE

Zaischnipsis schwarzi (Ashm.), new combination

Charitopus schwarzi Ashm. Proc. Ent. Soc. Wash. vol. IV, p. 11, 1896.

It has been pointed out by Mercet (Bol. R. Soc. Espan. Hist. Nat. 22, p. 51-54, 1922) that the genus *Charitopus* Foerster belongs in the family Encyrtidae and not in the Eupelmidae where Ashmead placed it. The species *Charitopus schwarzi* Ashm., as represented by the type in the U.S. National Museum, is a eupelmid, hence does not belong in *Charitopus*. In Ashmead's generic key it runs rather easily to the genus *Ischnopsis* Ashm. except that the eyes are not distinctly pubescent. The genotype of this genus (*I. ophthalmica* Ashm.) is not available for comparison, but the agreement of *Charitopus schwarzi* with the description seems sufficiently close to warrant placing the species, at least tentatively, in that genus. It differs from the description of the genotype species by being somewhat smaller, by being dark bronze-green instead of bluish in color, by having the wings hyaline instead of fuscus with white spots, and by having the ovipositor equal in length to the abdomen instead of only half the length of abdomen. There is a single longitudinal row of black spines ventrally on each of the first, second and third segments of the middle tarsus.

The generic name *Ischnopsis* Ashm. is preoccupied by *Ischnopsis* Walsingham, and *Zaischnopsis* was substituted for it by Ashmead (Proc. Ent. Soc. Wash. VI, p. 126, 1896).

Eupelmus cushmani (Crawford)

Cerambycobius cushmani Cwfd., Proc. Ent. Soc. Wash. 9, p. 158, 1908.

Cerambycobius townsendi Cwfd., Proc. U.S. Nat. Mus. 43, p. 166, 1912. New syn.

Cerambycobius cushmani (Cwfd.) Pierce & Cushman, Proc. Ent. Soc. Wash. 17, p. 165, 1915.

Eupelmus cushmani (Cwfd.) Jaynes, U.S. Dept. Agr. Tech. Ser. Bul. 363, p. 6, 1933.

I have carefully compared the type of *Cerambycobius cushmani* Cwfd., described from Texas as a parasite of *Anthonomus grandis* Boh., with the type of *C. townsendi* Cwfd., originally recorded as a parasite of *Anthonomus vestitus* Boh. in Peru, and can find nothing to distinguish them. The species apparently parasitizes or is associated as a secondary parasite with a wide variety of hosts including the two species of *Anthonomus*, several species of Bruchidae, *Alabama argillacea* (Hbn.), *Pectinophora gossypiella* (Saund.) and *Saissetia oleae* (Bern.). Specimens are in the U.S. National Museum from Argentina, Brazil, Colombia, Panama, Trinidad, Guatemala, Puerto Rico, Texas and Hawaii.

Family TORYMIDAE

Megastigmus slossonae Crosby

Megastigmus slossonae Ashm., (in Slosson list), Ent. News, vol. 7, p. 264, 1896, *nomen nudum.*

Megastigmus slossonae (Ashm.) Crosby, Ann. Ent. Soc. Amer. vol. 6, p. 157, 1913.

Megastigmus americanus Milliron, Amer. Mid. Nat. vol. 41, pp. 268, 1949. New syn.

This name, first published as a *nomen nudum* in the Slosson list of Hymenoptera from Mt. Washington (above citation to Ent. News) was later mentioned by Crosby accompanied by enough description to validate it. Crosby stated that a female in the National Museum from Mt. Washington bearing Ashmead's manuscript name, *Megastigmus slossonae*, agreed exactly with specimens reared from *Sorbus* seeds in New York State that he considered represented merely a lighter colored form of *M. brevicaudis* Ratz. This form he characterized as

having a large proportion of the specimens uniform brownish yellow, with the legs light yellow and the antennae and ovipositor brownish.

The specimen from Mt. Washington referred to by Crosby is still in the National Museum Collection and bears, in addition to the Ashmead name label, a label "*M. brevicaudis* det. Crosby." This specimen is considered to be the holotype of *Megastigmus slossonae* Crosby and has been given the U.S. National Museum type no. 59351. It is accompanied in the collection by a female labeled "C. U. Exp. No. 793, May 29, 1909, Jamesville, N.Y." The latter specimen is considered a paratype.

In his recent excellent paper entitled "Taxonomic and Biological Investigations in the Genus *Megastigmus*," H. E. Milliron has treated the light colored form of *M. brevicaudis* reared by Crosby from *Sorbus* seeds in New York State as a new species to which he gave the name *americanus*. Unfortunately Milliron overlooked or failed to realize the fact that the name *slossonae* had been validated by Crosby. The holotype of *slossonae* differs in no way from the description of *americanus*. The paratype specimen is exactly like the holotype and this paratype of *slossonae* is evidently from the same reared series as the allotype of *americanus*. There seems to be no possible doubt that *americanus* Milliron must be considered a synonym of *slossonae* Crosby.

Family EURYTOMIDAE

Bephratoides striatipes (Ashm.), new combination

Bephrata striatipes Ashm., Mem. Carnegie Mus., vol. 1, p. 462, Pl. XXXIII, fig. 4, 1904.

Bephrata striatipes Ashm. was described from two female specimens collected by H. H. Smith at Para, Brazil. Both specimens are now in the U.S. National Museum in fair condition. The species is not a *Bephrata* but is congeneric with *Bephratoides maculatus* Brues, genotype of *Bephratoides* Brues. This genus differs from *Bephrata* by having the occiput deeply concave, the anterior ocellus located in the scrobal cavity, the antennal funicle five segmented, and the pronotum quadrate or very nearly so.

Aximogastra cultriformis (Ashm.), new combination

Bephrata cultriformis Ashm. Jour. Linn. Soc. Lond. Zool., vol. 25, p. 146, 1894.

The type of this species, a female from the island of St. Vincent, W.I., is in the U.S. National Museum. It is not a *Bephrata*, differing from that genus especially by having the head convexly rounded in front instead of nearly flat, the anterior ocellus located in the scrobal cavity, the postmarginal vein much longer than the marginal and at least twice as long as the stigmal vein, the abdomen knife-blade shaped and fully twice as long as the combined head and thorax, and the hypopygium extending nearly to the apex of abdomen. These characters are those of the genus *Aximogastra* and the species resembles the genotype, *A. bahiae* Ashmead, in many respects. It is easily distinguished from *bahiae* by the fact that the ventral side of the anterior coxa is without a deep channel or groove, and the cheek does not have a carinate posterior margin. These two characters ally the species with *Harmolita* Motschulsky but the strongly compressed abdomen, location of the anterior ocellus in the scrobal cavity and the venation are unlike *Harmolita*. I believe the species is best placed in *Aximogastra*.

Prodecatoma cooki (How.), new combination

Decatomidea cooki How., U.S. Dept. Agr. Div. Ent. (Tech. Ser.) Bul. 2, p. 25, 1896.

Prodecatoma phytophaga Crosby, Can. Ent. 41, p. 50, 1909. New synonymy.

Eurytoma cooki (How.) Girault, Can. Ent. 48, p. 337, 1916.

Prodecatoma phytophaga (Crosby) Gahan, Proc. Ent. Soc. Wash. 26, p. 48, 1924.

The female holotype of *Decatomidea cooki* Howard has been compared with two paratypes of *Prodecatoma phytophaga* Crosby and found to be the same species. The species belongs in the genus *Prodecatoma* Ashm. It is a seed-chalcid infesting the seed of grape and also those of the Virginia creeper. In the National Collection are specimens from Michigan, New York, Ohio and Virginia. Howard mentions specimens sent to C. V. Riley by Dr. Franz Loew of Vienna, Austria, which he states were reared from seeds of *Vitis californica* imported into Austria from California. I have been unable to locate these specimens but I strongly suspect that they are not the same species as Howard's type. Howard stated that the figure (fig. 10) accompanying his description was drawn from one of the specimens received from Dr. Loew. Among the more than 50 specimens of *cooki* in the National Collection none shows the extensive yellow coloration indicated in this figure. It, therefore, appears to me very possible that the figure really represents a species different from *cooki*.

Family PTEROMALIDAE

Tribe Cleonymini

Epistenia polita (Say), new combination

Spalangius polita Say, Contrib. Maclur. Lyc. Philadelphia, vol. 2, p. 79, 1828; Le Conte, Writ. Th. Say N. A. Entom. vol. 1, p. 382, 1859.

Spalangia polita (Say) Ashmead, Proc. Ent. Soc. Wash. vol. 3, p. 35, 1894.

This species has remained unrecognized since its original description. The type, now lost, was said to have been collected on Senipuxent Island, Virginia. Certain characters given in the description mark the species as indubitably an *Epistenia* and a specimen in the National Museum collection taken at Washington, D.C., September 15, 1944, by Morton Vogel, seems to fit the description perfectly. I have labeled this specimen "neotype". A specimen from Brownsville, Texas, collected by J. N. Knull, May 22, 1935, appears to be the same although having the legs somewhat lighter testaceous.

As represented by these two specimens, the species is extremely similar to *Epistenia osmiae* Ashmead differing mainly by being slightly larger and somewhat less bluish (more greenish) in color.

Solenura Westwood

Solenura Westw., Trans. Ent. Soc. Lond. 1868, Proc. p. XXXVI; Thesaur. Entom. Oxon. p. 143; Pl. 26, fig. 10, 1874.

Ormyrodes Brues, Bull. Wisc. Nat. Hist. Soc. vol. 5, p. 46, 1907. New synonymy.

One specimen in the National Collection taken by C. F. Baker at Sandakan, Borneo, seems to agree quite completely with Westwood's description and figure of *Solenura telescopica* Westwood, (the genotype of *Solenura*) originally described from Java.

The type of *Ormyrodes carinatus* Brues (genotype of *Ormyrodes*) was recently received from the Milwaukee Public Museum for study. This type, which was collected in Cape Colony, Africa, has very little relation to *Ormyrus* Westwood or to the family Torymidae where Brues placed it. In my opinion it belongs in the family Pteromalidae, tribe Cleonymini, and is not separable by any satisfactory generic characters from *Solenura* Westwood. Specifically it is quite distinct from *S. telescopica* Westwood. The apical three segments of the abdomen are elongate and tubular but not nearly as long as in *telescopica*; the cerci of the last segment are located near its middle instead of near its apex as in *telescopica*; and the dorsal carina originates at the base of the fourth tergite instead of at its middle. The color of body is coppery black with no green patches; legs brownish fuscous, the hind femora brownish black.

The species *O. carinatus* should be transferred to *Solenura.* (New combination.)

Tribe Pteromalini

***Lariophagus dryorrhizoxeni* Ashm., new combination**

Macroglenes dryorrhizoxeni Ashmead, Trans. Amer. Ent. Soc. XIII, p. 133, 1886.

The types of *Macroglenes dryorrhizoxeni* Ashm. are congeneric with *Lariophagus texanus* Cwfd. and differ from that species only by having a more prominent neck on the propodeum, by having funicular segments 1 to 4 longer than broad, and by having all femora yellow instead of blackish.

Besides the types which were from Jacksonville, Fla., I have seen two specimens from Presque Isle, Erie, Pa., July 9, 1934, taken by George Wallace.

***Catolaccus hunteri* Crawford**

Catolaccus hunteri Cwfd., Proc. Ent. Soc. Wash. IX, p. 160, 1908.
Catolaccus townsendi Cwfd., Proc. U.S. Nat. Mus. 43, p. 172, 1912.

An article by Paul A. Berry (Jour. Econ. Ent. 40, p. 804, 1947) discussing the parasites of *Anthonomus vestitus* Boh. in Peru, includes a statement that "*Catolaccus townsendi*, recorded as *C. hunteri* in literature in the United States, is known as a parasite of *Anthonomus grandis* Boh." Berry has thus indicated that *hunteri* and *townsendi* are the same species but without indicating which name should have precedence. Berry's material of *Catolaccus* was originally identified by me. After studying the types of *townsendi* and *hunteri* in conjunction with large series of additional specimens reared from cotton bolls in Peru and in the United States, I became convinced that the Peruvian parasite could not be separated from the North American form and so informed Mr. Berry. *Catolaccus townsendi* should be treated as a synonym.

Tribe Brachyscelidiphagini

***Austroperilampus* Dodd**

Austroperilampus Dodd, Trans. Roy. Soc. So. Australia, vol. 48, p. 166, 1924.
Pembertonia Gahan, Ann. Ent. Soc. Amer. vol. 40, p. 283, 1947. New synonymy.

Alan P. Dodd of the Department of Public Lands, Queensland, Australia, has called to my attention the omission of his genus *Austroperilampus* from the paper "Notes on Some Gall-Inhabiting Chalcidoidea" by Gahan and Ferriere and has suggested the probability that *Pembertonia* Gahan, described in that paper, is a synonym of his genus. I have compared the type specimens of *Pembertonia ficicola* Gahan (the genotype) with Dodd's excellent description of *Austroperilampus* and find them to be in complete agreement. *Austroperilampus* should therefore replace *Pembertonia* in the generic key and the latter name be relegated to synonymy.

In one of his privately published pamphlets, A. A. Girault [Indications (In New Insects) of Ruling Power and Law in Nature, p. 3, 1925.] has stated that *Austroperilampus* is the same as *Meselatus* Girault.The description of *Meselatus* (Ins. Insc. Mens. vol. 10, p. 151, 1922) is short and inadequate but the characterization of the stigmal vein as short and curved can hardly be said to apply to *Austroperilampus.* The synonymy of *Austroperilampus* with *Meselatus* is considered questionable.

***Austroperilampus leai* Dodd**

Austroperilampus leai Dodd, Trans. Roy. Soc. So. Australia vol. 48, p. 166, 1924.
Pembertonia ficicola Gahan, Ann. Ent. Soc. Amer. vol. 40, p. 284, 1947. New synonymy.

Comparison of the types of *Pembertonia ficicola* Gahan with the description of *Austroperilampus leai* Dodd shows them to agree quite completely. *P. ficicola* should therefore be placed in synonymy.

Family PODAGRIONIDAE

***Podagrion coeruleo-viride* Strand**

Podagrion coeruleo-viride Strand, Arch. f. Naturgesch., Bd. 1, H. 2, p. 154, 1911.
Podagrion brasiliensis (How.) Ashmead, Mem. Carnegie Mus. I, p. 401, 1904.

The original description of *Podagrion brasiliensis* Howard (Jour. Linn. Soc. London Zool. XXV, p. 83, 1894) closes with the following statement: "Described from two female specimens from St. Vincent. The specific name is derived from the fact that Mr. H. H. Smith has also collected the form in Brazil, several specimens occurring in a collection now in the hands of Mr. Ashmead." The specimens referred to as having been collected by Smith in Brazil were later recorded by Ashmead (loc. cit.) under the name *Podagrion brasiliensis* How. The only localities mentioned were Santarem and Chapada but along with specimens bearing these locality labels was also one labeled "Corumba, March." These specimens, which are all alike, have been compared with one of the cotypes of *brasiliensis* Howard from St. Vincent and found to be larger, bluish-green instead of black in color, the antennal funicle uniformly brownish yellow instead of with a conspicuous yellow band, the posterior femur with five rather large black teeth instead of seven smaller teeth, and the ovipositor longer than the body instead of a little shorter than the body. They are quite certainly not *brasiliensis* How. On the other hand they agree quite completely with the description of *P. coeruleo-viride* Strand and with specimens I have previously identified as that species from Trinidad and from Sao Paulo, Brazil.

It is unfortunate that the name *P. brasiliensis* Howard is thus based upon specimens from St. Vincent and so far as at present known the species does not occur in Brazil.

The Importance of Insect Control in a Forest Management Program[1]

By R. F. Morris[2]
Dominion Entomological Laboratory
Fredericton, N.B.

Swaine and Craighead (1924) have presented evidence that outbreaks of the spruce budworm occurred in Eastern Canada in 1806 and in 1878. In those days the wood supply appeared to be unlimited and the forest represented, to some extent, an obstacle that had to be removed so that the land could be cultivated. Balsam fir, the tree principally affected by the budworm, was seldom used for lumber when spruce was available. It can hardly be considered, therefore, that these early outbreaks caused much direct economic loss. If the trees had not been killed by the budworm, over-maturity and related factors would have removed them to make way for a new stand. In fact, were it not for the undesirable effects of budworm outbreaks on subsequent forest composition, it might even be argued that they were beneficial under certain conditions.

The situation is quite different, however, when we consider the more recent outbreaks, namely, the one that started in 1909 and, more particularly, the present one that started in Ontario and is now reaching epidemic proportions in New Brunswick and eastern Quebec. It is true that some of the extensive mortality occurs in areas where the question of economic accessibility makes the computation of loss very uncertain. However, it also occurs in accessible areas and in areas under operation, where the economic loss is very real and direct. The

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[2]Agricultural Research Officer.

rapid development of the pulp and paper industry and the prevalence of balsam fir in present stands have greatly increased the importance of this tree. Hence insect control becomes important with increased utilization and will become even more important in the management programs that are now necessary, at least in some areas, if utilization on a sustained basis is to be realized.

It cannot be said that silvicultural management is being practised on an appreciable scale as yet, but it has received a great deal of attention in recent years. With the end of accessible virgin forests in sight, it is becoming appreciated that the forest is a crop to be renewed rather than a resource to be exploited like a mineral. In areas where new land cannot be bought or leased, operating companies must now face the prospect of securing sustained annual yield from their present limits. In fact, they are beginning to wonder whether, from the point of view of long-term rather than immediate economics, this may not prove less expensive than the continued expansion of operations into areas farther from the mills. There is little doubt that intensified management increases the immediate cost of wood. Improved cutting methods to secure maximum yield and adequate reproduction of desirable species, and the building and maintaining of a permanent road system, are two of the factors that increase immediate cost. Against these must be balanced the increased future yields and the improved facilities for fire and insect protection. Under such a program, the present and future worth of both land and growing stock is tremendously increased, and the importance of insect control increases proportionately. Moreover, since the allowable annual harvest is calculated on the basis of growth and replenishment, the management program can be seriously disrupted by an insect outbreak that removes a considerable portion of the growing stock, or, by decreasing the rate of growth, reduces yield below anticipated levels.

It may be thought that forest insect problems in Canada will disappear after forest management is well established. It is certainly true that the damage caused by several important pests is associated with over-maturity and with poor vigour. It is also true that in some European countries, where close utilization is necessary, forest insects do not constitute the important problem that they do in Canada. However, the hope that management will solve all forest insect problems in Canada seems overly optimistic. There are other insects that can cause damage irrespective of stand age or composition and we are always subject to accidental introductions such as that of the European spruce sawfly. Although the orderly harvesting of trees at maturity should greatly decrease losses from some species, it is not at all certain that the age of economic maturity will be exactly equal to the age at which the trees become vulnerable to insect damage. Insect protection will always require attention in any management program, and management plans based on forestry concepts alone should be adjusted, in so far as economically feasible, to meet this need.

The relationship between insect control and silvicultural management in Canada has recently been described in some detail (Prebble, *et al*, 1951). It is proposed, therefore, to limit the present paper to a discussion of some of the problems that the entomologist encounters when he becomes involved in a management program, as well as to some of the accompanying advantages. For illustrative purposes I shall draw largely upon the spruce budworm and upon the Green River Management Project, with which I have been associated during the past six years.

The first question for the entomologist to decide is how far he should go in forest management and where his responsibility should end. Ecological investigations are now recognized as a major phase of forest insect research.

Such investigations, with particular reference to the ecological relationships between the insects and the host trees and stands, have a direct bearing on silviculture and management. As a minimum, the entomologist can study these relationships under the particular forest conditions which happen to exist near his laboratory and report them in entomological journals, leaving it to the forester to read them and to interpret them silviculturally. If the entomologist's responsibility ends here, the task will be relatively simple. Past experience suggests, however, that the results are likely to receive little practical application if they are carried on further than this. Very few practising foresters, or even research foresters, take the time to study entomological literature. Furthermore, the entomologist becomes too detached from the problems of management, and his work may not lend itself to practical application. It is one thing to determine the ideal type of forest to be aimed at and another to determine how it can be approached within the limits imposed by the practical necessities of the forest industries.

As the next possibility, the entomologist may do his work on a forestry experiment station owned and operated by the government. Here he will generally have a variety of forest conditions to work with and may co-operate with the research foresters in outlining experimental cuttings or management plans. The principal advantage of this system is that the research staff has complete control over the handling of the area and can initiate any type of experiment that is desired. Criticism of this system has generally been based on the small scale of many of the experiments, with results not considered applicable to large timber limits, and on the neglect of economic considerations. Experimental forests do not have to pay dividends, and operating companies are slow to adopt methods that they feel have not been subjected to the severe test of economic feasibility. These weaknesses are not necessarily inherent in the system and could be overcome by the establishment of experimental forests large enough to represent management units and by a system of complete cost-accounting on all operations; the cost of the fundamental biological or forestry research that is conducted at these stations should not be confused with management costs.

Another possibility is to conduct the work on a management area that is being operated by a company. The Green River Project, which was conceived at a meeting of the Canadian Pulp and Paper Association, is set up on this basis. Policies are decided by a work committee that meets twice a year and is composed of representatives of the operating company, the Canada Department of Agriculture, the Canada Department of Resources and Development, and the New Brunswick Government, which owns the land. The men responsible for research in entomology, forestry, and forest pathology report to this committee. The area involved, 400 square miles, is relatively large; and since the company is not legally bound to accept recommendations that are made, the criterion of economic feasibility must be satisfied. For these reasons, management measures that prove successful are likely to be adopted by other operators in similar forest types. Limitations that should be mentioned include the lack of control by the research staff, particularly in certain types of forestry experiments, and the fact that progress is dependent, as in any co-operative venture, upon the goodwill of the personalities involved and their willingness to consider different ideas and points of view.

Lastly, there is the "pilot-plant" system, which is now being tested in the Northeastern United States by silviculturists and entomologists. Arrangements are made with individual land owners, usually on fairly limited areas, whereby

the forester prepares the management plans and marks the trees to be cut, and the owner agrees to operate according to the methods recommended.

It is too early, I believe, to conclude which of these methods will prove the best means of integrating entomology in management programs, or whether each will have its place, depending upon the problems involved in different regions. All are experiments of recent origin, and, because of the long-term nature of management projects, their effectiveness will not be known for some years.

The entomologist who becomes associated with co-operative projects of this nature will find that the basic nature of insect problems is generally not well understood by either practising or research foresters. The correction of this situation is one of the first requirements if recommendations affecting management plans are to be understood and accepted. Direct control methods seem to have a considerable appeal to the operator in comparison with the indirect method of making the forest environment unsuitable for insect multiplication and damage. He wonders, for example, why the impressive control of the European spruce sawfly by disease and parasites is not equally applicable to native insects. Conversely, the entomologist will gain an appreciation of many forestry problems that are not in textbooks. He will find that certain operating difficulties and limitations, which he previously brushed aside as mere excuses, have a very real basis. This frank exchange of ideas and view-points should be one of the greatest assets of co-operative programs.

The advantage to the entomologist of having a variety of forest conditions in which to work and having a voice in deciding what conditions shall be established has already been mentioned. However, for most, if not all, forest insects adequate techniques for field studies have yet to be developed, and the number of forest types that can be studied in detail is therefore seriously limited. It is relatively easy, after an outbreak has passed, to study its effects in different forest types and under various silvicultural treatments and to obtain useful relationships between vulnerability and silviculture. The explanation for these relationships will be understood, however, only if ecological studies can be conducted in each forest condition during the outbreak, and particularly during its initial stages. This generally entails, as a minimum, the measurement of the population at each developmental stage of the insect and the study of natural control factors so that quantitative life-equations can be prepared.

In 1950, with a sampling party generally composed of six men, only five forest conditions could be studied in this detailed way on the Green River Watershed. Not only did this fail to provide for a replication of plots in any one type, but the standard errors of the population means were in the vicinity of 20 per cent. Either superior techniques remain to be discovered or else very large staffs are required for such work. Sampling can be entrusted to untrained seasonal labour only if the work is constantly checked. On the other hand, if a large permanent staff is built up, it is difficult to keep them occupied during the rest of the season and other administrative problems are created. Married men do not wish to live on a management area five or six months of each year unless provision is made for their families. We can recall, not without some regrets, "the good old days" when the entomologist, with his microscope set up in some secluded corner, did not have to bother about such problems. It is now being appreciated, however, that complex ecological problems requiring co-ordinated effort cannot be solved on this basis. My present object is not to suggest a solution, but only to show that it is not feasible, with field parties of ordinary size and present sampling techniques, to obtain statistically sound data on more

than one or two forest types at the same time. Replication in time, rather than in area, may provide a partial solution, but only if population dynamics in a given stand are found to be rather similar from year to year.

Another feature of the work on a management program, and one that the entomologist will find somewhat disconcerting at first, is the need for constant attention to economics. Forest management is based largely on economics; and although most companies at the present time consider immediate economics only, under planned management it is necessary to compute both immediate and future values and costs. This applies to insect protection and control as well as to other factors. For example, the Division of Forest Biology was recently asked to inspect an area of 1,000 square miles at Forestville, Quebec, where a management program was under consideration. The Forestville project involves an economic comparison, including both present and future values and costs, with the assumptions: first, that the area is harvested by usual methods; and, secondly, that it is placed under sustained yield management. As one of the factors involved, it was desired to know what the annual cost of insect protection would be if the area were placed under management. At the present stage of our knowledge, any answer would have to be almost purely conjectural, since there are no previous records or experience on which to draw in making such estimates. The permanent and adequate road system of a managed area should increase facilities for insect detection and permit flexibility of operations for control or salvage, but will this balance economically the intensified detection and control services required? Will aeroplane spraying become a feasible method for controlling certain types of insect activity and how much will it cost? Will economic rotation ages and cutting cycles promote greater resistance to insect damage and, if not, to what extent will it be economical to modify them in order to buy protection? How large must the area under management be in order that such efforts will not be nullified by insect populations developing in adjacent unmanaged lands? All these questions, and many more, remain to be answered before we can begin to estimate the cost of insect protection in a management program. In the meantime, recommendations for modifications that entail increased cost must be made with caution. Because of the absence of management areas for study in the past, the belief that management will bring increased protection is still based on presumptive, or at least indirect, evidence; and our knowledge of what constitutes stand resistance is still limited and inexact. This knowledge will never be improved, of course, unless the entomologist is willing to commit himself to certain recommendations, but these should first be subjected to very critical analysis.

In conclusion, attention is drawn to the need for long-term thinking and planning. The entomologist is accustomed to starting experiments that can be completed in a year or, at most, in a few years. In management work, however, he must follow the practice of the research forester and resign himself to the initiation of certain studies and experiments for which many of the answers may not be obtained during his lifetime. The Green River Project was initiated about six years before the beginning of a budworm outbreak, but it was soon realized that the conversion of such a large area of overmature balsam to a budworm-resistant forest was hardly feasible in this short period, and it is anticipated that many trees will be killed in the present epidemic. It is now hoped that the desired forest conditions can be established in time for the next outbreak, some 30 or 40 years hence. Although the study of the present outbreak should serve in the development of field techniques and should provide more exact information on the nature of stand resistance, the effectiveness of

control by silviculture and management will not be fully known until one or more future outbreaks have been experienced. Appreciation of the long-term nature of these projects is essential in order that the work will be continued long enough to provide definite conclusions on the role of entomology in a forest management program.

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Notes on the Biology of *Pleroneura borealis* Felt (Xyelidae: Hymenoptera)[1]

By F. E. Webb[2] and R. S. Forbes[3]
Dominion Entomological Laboratory
Fredericton, New Brunswick

Introduction

In 1945 injury to shoots of balsam fir, *Abies balsamea* (L.) Mill., by sawfly larvae was very common in York and Madawaska counties, New Brunswick. Since then, similar injury has been noticed throughout most of New Brunswick, eastern Nova Scotia, the upper peninsula of Michigan and northern Wisconsin.

New Brunswick specimens were identified by Dr. O. Peck of the Systematic Unit, Division of Entomology, as presumably *Pleroneura borealis* Felt, the specimens running to this species in Ross' Key (2); however, as stated by Ross (3), the recognition of species in the genus is not at present based upon fundamental characters. *P. borealis* was originally described in 1917 by Felt (1) from three specimens collected at Lake Clear, N.Y., in 1907. Except for the taxonomic revision by Ross (2), no other reference to this species was found in the literature.

The discussion that follows is based on field observations and insectary rearings of larvae in New Brunswick. High mortality of larvae in the shoots and of the overwintering stages in the soil prevented detailed ecological studies of the insect under cage conditions. During two years of study, only four adults (three females and one male) were successfully reared from approximately 1000 field-collected larvae. This high mortality was due largely to unsatisfactory rearing conditions.

The method of rearing finally adopted was as follows. Infested twigs were placed in jars of water laid on large sheets of paper, the edges of which had been turned up to prevent the escape of larvae. The larvae were collected as they dropped, at 2-hour intervals, and put in screened boxes filled with sifted earth. The boxes were kept in a shallow trench outside, covered with sphagnum moss and balsam-fir boughs for overwintering. In the spring the boxes were taken from the ground and placed within large cages for adult emergence.

Description of Early Stages

The egg is whitish, more or less oval, and measures approximately 1.1 mm. by 0.4 mm.

The larva is white, and when full-grown ranges in length from 4 mm. to 7 mm. The thoracic legs are weakly developed and the prolegs are represented by a pair of slight swellings on each abdominal segment. The plotting of the

[1]Contribution No. 7, Division of Forest Biology, Science Service, Department of Agriculture, Ottawa, Canada.

[2]Assistant Forest Entomologist.

[3]Assistant Forest Entomologist.

head measurements of 326 larvae, collected at 2-day intervals, showed five peaks. It is assumed that these peaks represent instars, the average head widths of which are estimated as follows: 0.33 mm., 0.44 mm., 0.57 mm., 0.73 mm. and 0.99 mm. These values agree well with the calculated values obtained by applying Dyar's principle.

Habits

Balsam-fir buds were inspected daily from early May to early June. Adults were found only between May 25 and 28. These were placed in sleeve cages, but, although mating occurred readily, no oviposition was observed. Eggs were seen on June 2, but since young larvae were found as early as May 29, oviposition probably commences any time after the middle of May.

FIG. 1. Young shoot of balsam fir attacked by *Pleroneura borealis* Felt. Dead needles removed showing larva in the axis of the shoot. (Photograph by W. A. Reeks).

The egg is laid soon after the bud scales drop, and is inserted into the tightly-packed needle cluster with the longitudinal axis parallel to the needles. The presence of the egg may be detected by a slight browning of the needles at the point of oviposition. Not more than one egg has been found to a shoot.

Larvae were observed feeding between May 29 and June 23. After crawling toward the tip of the new shoot, the young larva burrows into the axis and begins to mine toward the base of the shoot. When the larva reaches maturity it crawls out of the shoot, drops to the ground, and spins a thin, oval cocoon within an earthen cell. Dissections of cocoons showed that the insect can overwinter either as a larva or pupa. There is only one generation a year.

Damage

This insect prefers trees about 6 feet in height. Counts of 350 shoots from trees growing in the open and 350 from trees in the shade suggest that it has a slight preference for those growing in the open. On the faster-growing trees in the open the leader was never affected, and only rarely on those in shade. The

new shoots of the 2-, 3- and 4-year old whorls showed the heaviest attack. As the shoot grows, the axis is tunnelled by the larva (Fig. 1). This mined shoot dies and, as the needles turn red, the effect is somewhat similar to that produced by a late frost. After the larva leaves the shoot, the affected part generally drops. Although this injury is common and some new foliage is destroyed, the tree is not seriously damaged. This insect is principally a pest of balsam fir, but it has been found also on planted white fir, *Abies concolor* (Gord.) Engelm.

Parasitism

The only parasite reared from *P. borealis* was an Ichneumonid, identified by Mr. G. S. Walley as *Scambus* sp. near *hispae* (Harr.).

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A List of the Wisconsin Species of Membracidae

By CLIFFORD J. DENNIS
University of Wisconsin

Subfamily Membracinae
Campylenchia latipes (Say)
Enchenopa binotata (Say)
Subfamily Centrotinae
Microcentrus caryae (Fitch)
Subfamily Smiliinae
Tribe Polyglyptini
Entylia bactriana Germar
Publia concava (Say)
Vanduzea arquata (Say)
Vanduzea triguttata (Burmeister)
Tribe Smiliini
Cyrtolobus arcuatus (Emmons)
Cyrtolobus discoidalis (Emmons)
Cyrtolobus fenestratus (Fitch)
Cyrtolobus fuliginosus (Emmons)
Cyrtolobus fuscipennis Van Duzee
Cyrtolobus griseus Van Duzee
Cyrtolobus helena Woodruff
Cyrtolobus inermis (Emmons)
Cyrtolobus maculifrontis (Emmons)
Cyrtolobus pallidifrontis (Emmons)
Cyrtolobus pulchellus Woodruff
Cyrtolobus puritanus Woodruff
Cyrtolobus querci (Fitch)
Cyrtolobus tuberosus (Fairmaire)
Cyrtolobus vau (Say)
Ophiderma definita Woodruff
Ophiderma evelyna Woodruff
Ophiderma flava Goding
Ophiderma grisea Woodruff
Ophiderma pubescens (Emmons)
Ophiderma salamandra Fairmaire

Smilia cameuls (Fabricius)
Xantholobus intermedius (Emmons), new combination (*Cyrtosia. Cyrtolobus*)
Xantholobus lateralis Van Duzee
Xantholobus muticus (Fabricius)

Tribe Telamonini

Archasia belfragei Stal
Archasia galeata (Fabricius)
Carynota marmorata (Say)
Carynota mera (Say)
Glossonotus acuminatus (Fabricius)
Glossonotus crataegi (Fitch)
Glossonotus turriculatus (Emmons)
Glossonotus univittatus (Harris)
Heliria cristata (Fairmaire)
Heliria molaris (Butler)
Heliria scalaris (Fairmaire)
Palonica pyramidata (Uhler)
Palonica tremulata Ball
Telamona ampelopsidis (Harris)
Telamona compacta Ball
Telamona concava Fitch
Telamona decorata Ball
Telamona extrema Ball
Telamona maculata Van Duzee
Telamona monticola (Fabricius)
Telamona reclivata Fitch
Telamona spreta Goding
Telamona tiliae Ball
Telamona tristis Fitch
Telamona unicolor Fitch
Telamona wescotti Goding
Thelia bimaculata (Fabricius)
Thelia uhleri (Stal)

Tribe Ceresini

Acutalis tartarea (Say)
Micrutalis calva (Say)
Stictocephala albescens (Van Duzee)
Stictocephala basalis (Walker)
Stictocephala brevitylus (Van Duzee)
Stictocephala bubalus (Fabricius)
Stictocephala constans (Walker), new combination (*Spissistilus*)
Stictocephala diceros (Say)
Stictocephala lutea (Walker)
Stictocephala palmeri (Van Duzee)
Stictocephala taurina (Harris)
Stictocephala taurinaformis Caldwell
Spissistilus borealis (Fairmaire), new combination (*Stictocephala*)
Tortistilus curvata (Caldwell), new combination (*Stictocephala*)
Tortistilus inermis (Fabricius)

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